REMARKS

Informality Objections

The Examiner objected to the use of "/" in claims 1, 11 and 13. Applicant amended claims 1, 11 and 13 to remove reference to "/multiplexed" from the claims.

Applicant also amended claim 11 to correct a typographical error noted by the Examiner, and claim 13 to correct an additional informalities noted by Applicant.

Prior Art Rejections

The Examiner finally rejected claims 1-7 and 9-13 as being anticipated by U.S. Patent No. 5,324,401 to Yeung under 35 U.S.C. 102(b). In addition, the Examiner finally rejected claims 1-3 and 6-13 under 35 U.S.C. 102(b) as being anticipated by WO 01/02846 to Melman. These rejections are respectfully traversed.

a. Summary of the Invention

The present invention provides a multi-channel detection scheme for a bio-separation device, based on a multi-radiation source/common detector configuration, in which detection is conducted in a **time-staggered manner** across the channels.

In one embodiment, a single detector is coupled to a plurality of radiation sources, in a one detector - many radiation sources configuration. Each radiation source comprises an **LED**, which directs radiation at one detection zone of a single separation channel, and a single detector

is applied to detect light emissions from the detection zones of several separation channels in a time-staggered manner. There may be more than one detector in the entire detection system, each serving multiple radiation sources.

Bio-separation may be conducted simultaneously in all the channels in parallel, with detection **time-staggered manner** with respect to the light sources. The light sources direct radiation at the detection zones in a predetermined sequence in a cyclic manner, with the detector output synchronized to the light sources by a controller. The radiation sources **and** the detector are pulsed in synchronization in a time-staggered manner, wherein the control means controls the plurality of radiation sources to activate in successive pulses with respect to the radiation sources, and wherein the control means controls the synchronization of pulses of the radiation sources and detection sampling rate and period by taking into account the lag time in emitted radiation in adjacent separation channels, whereby desired detection for a separation channel covers a period when only the associated radiation source is on with respect to the detector.

In another embodiment, the controller controls the detector **and** radiation sources in a manner to effect detection of radiation emissions from the multiple separation channels in predetermined detection cycles, wherein **each detection cycle is repeated at a frequency to provide a desired detection time or duration**. The controller controls the radiation sources and detector in a manner to effect detection in a repeated scanning manner, across the detection zones of the separation channels, in a time-staggered type detection. In accordance with the present invention, cross talk between channels is virtually eliminated, thus improving signal to noise ratio.

b. Claim Amendments

Applicant disagrees with the final rejections. However, in the interest of furthering this case to allowance, Applicant amended the independent claims 1, 11 and 13 to specifically recites LEDs for the radiation sources, a single detector as recited in claim 2, and the control means as recited in claim 4 (including all the limitations in intervening claims).

c. 102(b) Rejection Based on Yeung

Applicant respectfully submits that Yeung does not teach all the features of the claimed invention, and therefore does not anticipate the invention as claimed.

Yeung is not directed to a time-staggered detection system for parallel channels, using a **single detector** and **multiple LED sources**. Instead, Yeung is directed to a **simultaneous** monitoring system for parallel channels of separations/capillaries. The parallel channels are **monitored simultaneously**, not in a time-staggered manner as in the context of the present invention as disclosed. Yeung refers to a multiplexing approach to detection, but in the context referenced in Yeung, the multiplexing detection refers to detection of the separation channels based on **simultaneously monitoring** of the multiple capillaries. To avoid any confusion with Yeung, Applicant amended the claims to omit reference to multiplexing.

Further, each of the separation channels in Yeung is not associated with a separate LED. Yeung teaches the illumination of several optical fiber/capillary separation channels with one light source. Accordingly, because its channels are not associated with separate LEDs, Yeung does not direct radiation to the separate channels in a predetermined sequence. Instead, Yeung refers to the selective irradiation/detection **in a particular channel**.

Further, Yeung does not teach the synchronizing of pulsing of the radiation sources and detection sampling rate and period by taking into account the lag time in emitted radiation in adjacent separation channels (as required by claim 4 of the present application). Such inventive approach reduces crosstalk. Instead, Yeung reduces crosstalk by deploying spacers, i.e., capillaries coated with black ink, between separation capillaries/channels (see, col. 16, lines 21-25).

In view of the foregoing, it is abundantly clear that Yeung does not teach a detection system comprising a plurality of radiation sources, **each** comprising an **LED** associated with **one of said separation channels**, a **single detector** associated with the plurality of radiation sources, and control means for controlling the radiation sources and detector in a manner such that **excitation radiation is introduced at the detection zone of each separation channel in a predetermined sequence** and **radiation emission from the detection zone of each separation channel is detected in a time staggered manner**, wherein **the control means controls the plurality of radiation sources to activate in successive pulses with respect to the radiation sources, and wherein the control means controls the synchronization of pulses of the radiation sources and detection sampling rate and period by taking into account the lag time in emitted radiation in adjacent separation channels, whereby desired detection for one of said separation channels covers a period when only the associated radiation source is on with respect to the detecting means,** as required by claim 1 of the present application, and similarly by claims 11 and 13 of the present application.

In view of the foregoing, the present invention as defined by claims 1, 11 and 13, and the claims dependent therefrom are patentable over Yeung.

d. 102(b) Rejection Based on Melman

Applicant notes that the Examiner did not apply Melman against claims 4 and 5 of the present application. Accordingly, claims 4 and 5 are patentable over Melman. Applicant amended claims 1, 11 and 13 to incorporate all the limitations of claim 4 and the intervening claims. Claims 1, 11 and 13 should be patentable over Melman.

Melman also does not anticipate the claimed invention. Melman at best discloses using a single controller to actuate each LED in a temporal sequence to improve signal to noise ratio. This refers to time sequence control of the LEDs only. Melman is silent on how to control the radiation sources **and** detecting means in a manner such that excitation radiation is introduced at the detection zone of each separation channel in a predetermined sequence and radiation emission from the detection zone of each separation channel is detected in a **time staggered manner,** wherein the control means controls the plurality of radiation sources to activate in successive pulses with respect to the radiation sources, and wherein the control means controls the synchronization of pulses of the radiation sources and **detection sampling rate and period by taking into account the lag time in emitted radiation in adjacent separation channels,** whereby desired detection for one of said separation channels covers a period when only the associated radiation source is on with respect to the detector.

Accordingly, claims 1, 11 and 13, and the claims dependent therefrom, are not anticipated by Melman.

e. Entry of Amendment

In view that the present amendments merely incorporates the limitations of earlier present claims 2, 3 and 4, and the limitation of LEDs as separate radiation sources, these amendments do not raise new issues requiring additional searching, entry of the amendments after final action would be appropriate.

CONCLUSION

In view of all the foregoing, Applicant submits that the claims pending in this application are patentable over the references of record and are in condition for allowance. Such action at an early date is earnestly solicited. **The Examiner is invited to call the undersigned representative to discuss any outstanding issues that may not have been adequately addressed in this response.**

Respectfully submitted,

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Wen Liu
Registration No. 32,822

LIU & LIU
811 W. Seventh Street; Suite 1100
Los Angeles, California 90017
Telephone: (213) 830-5743
Facsimile: (213) 830-5741